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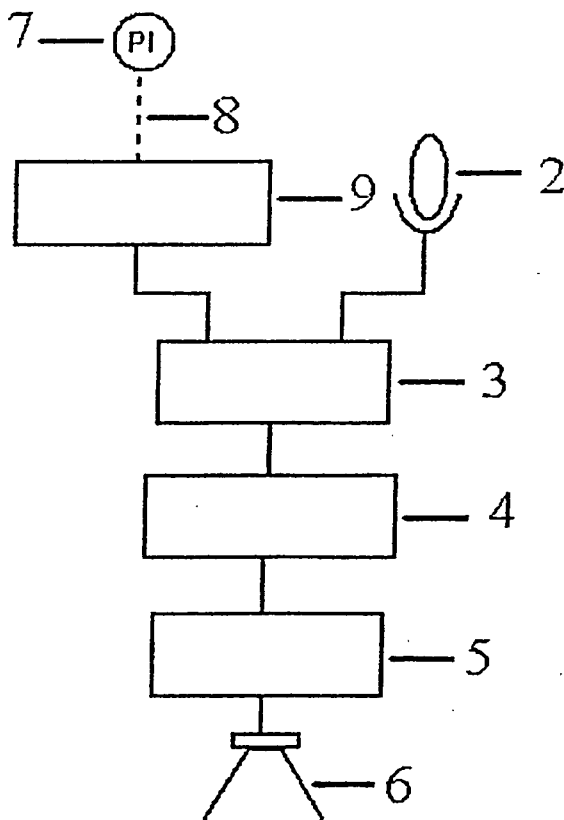
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(54) Title: **A HEARING AID**



(57) Abstract: The present invention relates to a hearing aid comprising a. a device being a noise generator for forwarding a natural or a synthetic "temple" noise (as herein defined); b. a sound microphone; devices a. and b., each forwarding the noise to c. a mixer; said mixer being connected to d. an amplifier; said amplifier being connected to e. an ear phone; all devices being connected to each other by suitable connecting means. Said hearing aid may be a complete unit, being assembled from separate parts of the hearing aid or may be a combination of parts of existing devices and a combination with the other parts.

WO 02/09473 A2



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A HEARING AID

The present invention relates to a hearing aid. (A hearing aid in connection with the present invention means a device insertable into/or connectable to the ear or into/to any suitable instrument, e.g. a cellular phone or the like.

There are known certain hearing aids. Most of the present hearing aids substantially enable the modification of the input signal by filtering out certain frequencies and by supporting high signals to noise ratios (S/N) in the amplifier being part of said hearing aids. Moreover, said hearing aids sometimes support directional amplification to reduce sources of noise outside the cone of attention.

However, these known hearing devices are not always satisfactory and many users complain that in some cases speech is not intelligible and the amplified sound is too noisy.

It has thus been desirable to design a hearing aid which would overcome the above disadvantages, i.e. it would have the natural characteristics of normal hearing. Such a hearing aid should be relatively simple to design, to be insertable into/or connectable to the ear and to be located in a comfortable manner therein. Said hearing aid should be substantially easy to manufacture and not be too expensive.

When the device according to the present invention is to be used as a hearing aid proper, it uses the natural or synthetic "temple" noise as the filtering and amplification aid. The amount of filtering and amplification aid applied is proportional to the speed of blood rushing in the "temple". Said amount may indirectly be measured by measuring the blood pressure or the body temperature.

"Temple" in connection with the present invention means the bone structure of a temple per se, a combination of the temple with the cochlea and the cochlea per se.

The present invention thus consists in a hearing aid comprising:

- a. a device being a noise generator for forwarding a natural or a synthetic "temple" noise (as herein defined);
- b. a sound microphone;
- c. devices a. and b., each forwarding the noise to
- d. a mixer; said mixer being connected to
- e. an amplifier; said amplifier being connected to
- f. an ear phone;

all devices being connected to each other by suitable connecting means.

The connecting means are preferably cables.

Said hearing aid may be manufactured and sold as one unit.

However, the various devices being parts of the hearing aid may be manufactured separately and assembled at a suitable place thus forming the hearing aid per se. It is well understood that the same may be part[s] of existing device[s] which parts are combined with the missing parts thus forming a hearing aid according to the present invention. Said possibilities are all within the scope of the present invention.

Very often a noise gate is inserted between the mixer and the amplifier. However, in some instances the mixer and the amplifier may constitute one part. These possibilities are also within the scope of the present invention.

The device for forwarding the "temple" noise can be, for example: 1) when the "temple" noise is a synthetic one: a commercially available Otoacoustic Emission recorder, e. g. Madsen Electronics- capella; or 2) when the "temple" noise is a natural one: a microphone such as a Shure TL 93 microphone located under a cup, the blood rush sound being captured for example in a computer, e.g. a laptop computer. The software may be, for example, a Microsoft sound recorder (AVI) and the hardware IBM Think Pad 600 with MWAVE (Sound Blaster compatible sound card). The hearing aid device, according to the present invention, is advantageously, when it is used as a hearing aid proper, mounted on a chip.

The device being a noise generator for forwarding a natural or a synthetic "temple" noise may also comprise a pressure indicator. The pressure indicator is a commercially available pressure indicator. In this case a computer may be used as noise generator.

Said device being a noise generator for forwarding a natural or a synthetic "temple" noise may also comprise a pressure transmitter, e.g. a handcuff type Digital Blood Pressure Monitor OMRON HEM-711. In this case the readings of the monitor are fed manually to the noise generator, e.g. a computer.

The natural or a synthetic "temple" noise may be obtained e.g. by recording naturally or synthetically the noise of the "temple". Advantageously this noise should be adapted to the ear. The noise measured is that near the "temple" of the ear i.e. of the Otoacoustic Emissions. The pressure indicator indicates the differences in the "temple" noise.

The synthetic "temple" noise may e.g. be obtained and measured continuously by locating a microphone continuously in the ear or in the "temple".

The output from the device being a noise generator for forwarding a natural or a synthetic "temple" noise is mixed with a sound microphone (device b), e.g. a Shure 16 A microphone.

The mixer used is, e.g., a MACKIE 1202VLZ Pro mixer. Mixer settings are preferably changed according to the listener but no frequency filtering has to be applied.

The output from the mixer is preferably fed to a "noise gate", if present, in order to provide an artificial threshold. The noise gate mutes the input signal until the volume exceeds the pre-determined threshold. The moment the volume exceeds the threshold the gate is opened and the signal may pass through. Advantageously there is present a "release" parameter which enables to specify how long the gate will remain open after the signal has dropped below the threshold level. This may be useful to keep the gate from chopping off the end of decaying notes in an "unmusical" way. The threshold level may be set according to the special requirements of the user, e.g. -25dbV and the release between 0-500ms preferably at 330ms. The hardware used may be, e.g. ELSYS 3630 Compressor/limiter/noise gate.

The threshold level, which is a natural feature of the ear, is, when no noise gate is present, determined by the hearing difficulty of the ear. The more difficult the hearing, the higher is the threshold level. Thus the threshold level is adjusted in accordance with the hearing of the customer. The threshold level is determined by the hearing difficulty the person experiences.

Should the noise gate not be present the output from the mixer will be transferred directly to the amplifier.

The amplifier/speaker combination used with an earphone socket is, e.g. an ALTEC LANSING Multimedia and the earphone is e.g. VIVANCO SR 900.

Advantageously the final hearing aid is a single chip fabrication, in which all components are mounted on a single Silicon chip.

The cables if used as connecting means are advantageously standard high quality coaxial microphone cables.

The present invention will now be illustrated with reference to the accompanying drawings without being limited by them. (the parts being used are in particular those

described herein). Similar or identical are being indicated by the same numerals. In said drawings:

Fig. 1 shows one embodiment of a hearing aid according to the present invention;

Fig. 2 shows another embodiment of a hearing aid according to the present invention; and

Fig. 3 shows a further embodiment of a hearing aid according to the present invention.

The hearing aid shown in Fig. 1 comprises:

Laptop Computer 1 forming a noise generator and Sound Microphone 2 being both connected to Mixer 3. Mixer 3 is connected to noise gate 4 which in turn is connected to amplifier 5. Amplifier 5 is connected to Ear Phone 6.

The various parts are connected to each other, as shown on the drawing, by suitable cables.

The hearing aid shown in Fig. 2 comprises:

Pressure Indicator (PI) 7, is connected, via control cable 8, to noise generator 9. Voice generator 9 and Sound Microphone 2 are both connected to Mixer 3. Noise Gate 4, Amplifier 5 and EarPhone 6 are identical to those parts of Fig.1.

The various parts are connected to each other also in this embodiment, as shown in the drawings, by suitable cables.

The hearing aid shown in Fig. 3 comprises:

Pressure Indicator 7, is connected in a similar manner as shown in Fig. 2 via control cable 8 to noise generator 9. Noise generator 9 and Sound Microphone are connected to a combined Mixer/Amplifier device 10, which in turn is connected to Ear Phone 6.

The various parts are connected to each other also in this embodiment, as shown in the drawing, by suitable cables.

As becomes apparent this Hearing Aid, which is an advantageous one does not comprise a Noise Gate and the Mixer and Amplifier form together one unit.

Claims

1. A hearing aid comprising:
 - a. a device being a noise generator for forwarding a natural or a synthetic "temple" noise (as herein defined);
 - b. a sound microphone;devices a. and b., each forwarding the noise to
 - c. a mixer; said mixer being connected to
 - d. an amplifier; said amplifier being connected to
 - e. an ear phone;all devices being connected to each other by suitable connecting means.
2. A hearing aid according to Claim 1, wherein said hearing aid is complete unit.
3. A hearing aid according to Claim 1, wherein said hearing aid is assembled from separate parts of the hearing aid.
4. A hearing aid according to Claim 1, wherein some of the part[s] of the hearing aid are parts of existing device[s] which parts are combined with the missing parts.
5. A hearing aid according to Claims 1 or 2, wherein a noise-gate is inserted between the mixer and the amplifier.
6. A hearing aid according to Claim 1, wherein the mixer and the amplifier constitute one part.
7. A hearing aid according to any of Claims 1 to 6, wherein the device being a noise generator for forwarding a natural "temple" noise is a microphone located under a cup, the bloodrush sound being captured into a computer.
8. A hearing aid according to Claim 7, wherein the computer is a laptop computer.
9. A hearing aid according to any of Claims 1 to 6, wherein the device being a noise generator for forwarding a synthetic "temple" noise is a commercially available Otoacoustic Emmission recorder.
10. A hearing aid according to Claims 1 to 9, wherein the device being a noise generator for forwarding a natural or a synthetic "temple" noise may also comprise a pressure indicator
11. A hearing aid according to Claim 1 or 10, wherein the device being a noise generator for forwarding a natural or a synthetic "temple" noise a pressure transmitter.

12. A hearing aid according to any of Claims 1 to 11, in which the noise of the temple near the ear is recorded artificially.
13. A hearing aid according to any of Claims 1 to 12, in which a microphone is located continuously on the temple.
14. A hearing aid according to any of Claims 1 to 7 and 9 to 13, wherein all components are mounted on a single Silicon chip.
15. A hearing aid as defined in Claim 1, substantially as herein defined with reference to the accompanying drawings.

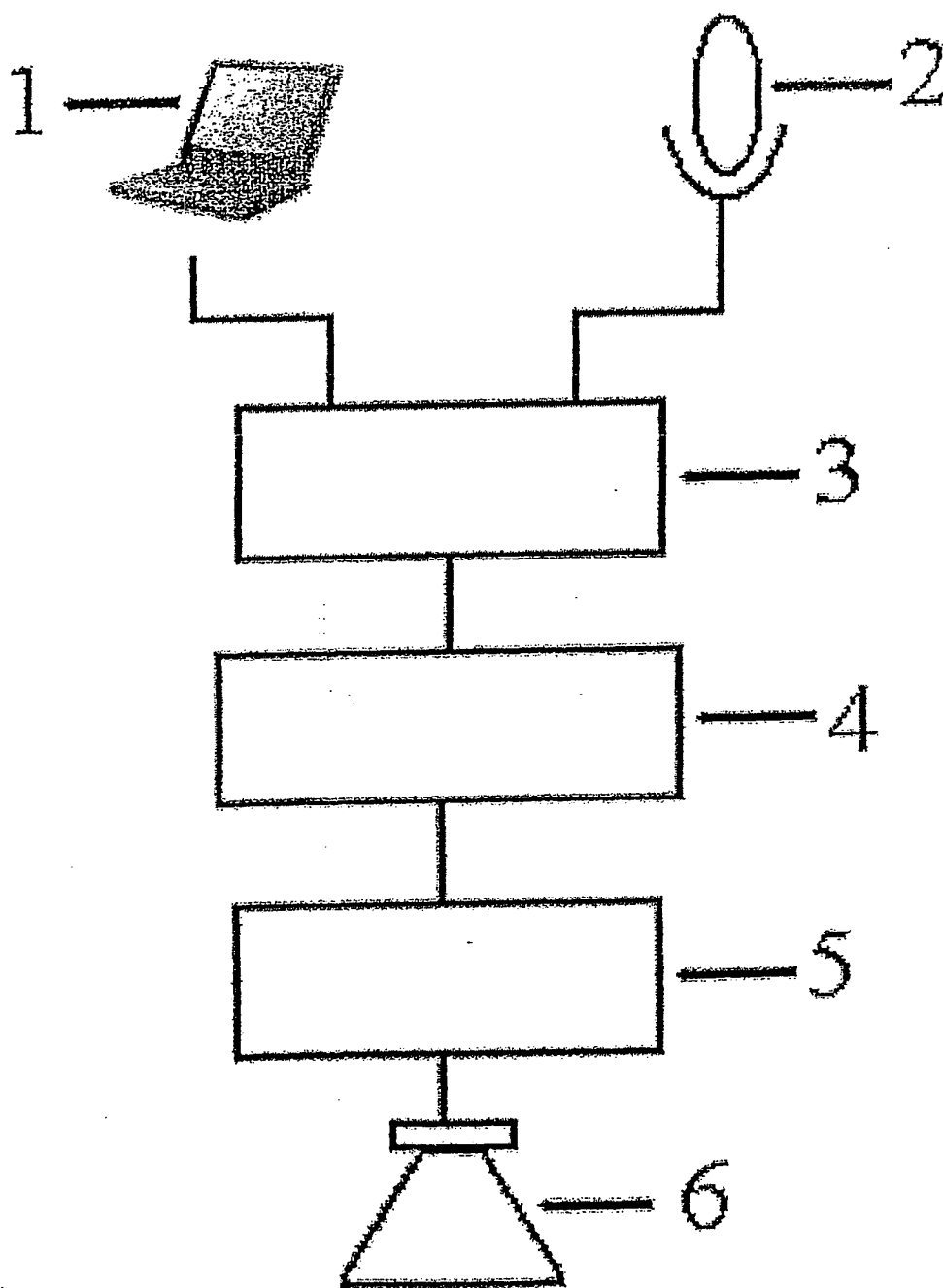


Figure 1

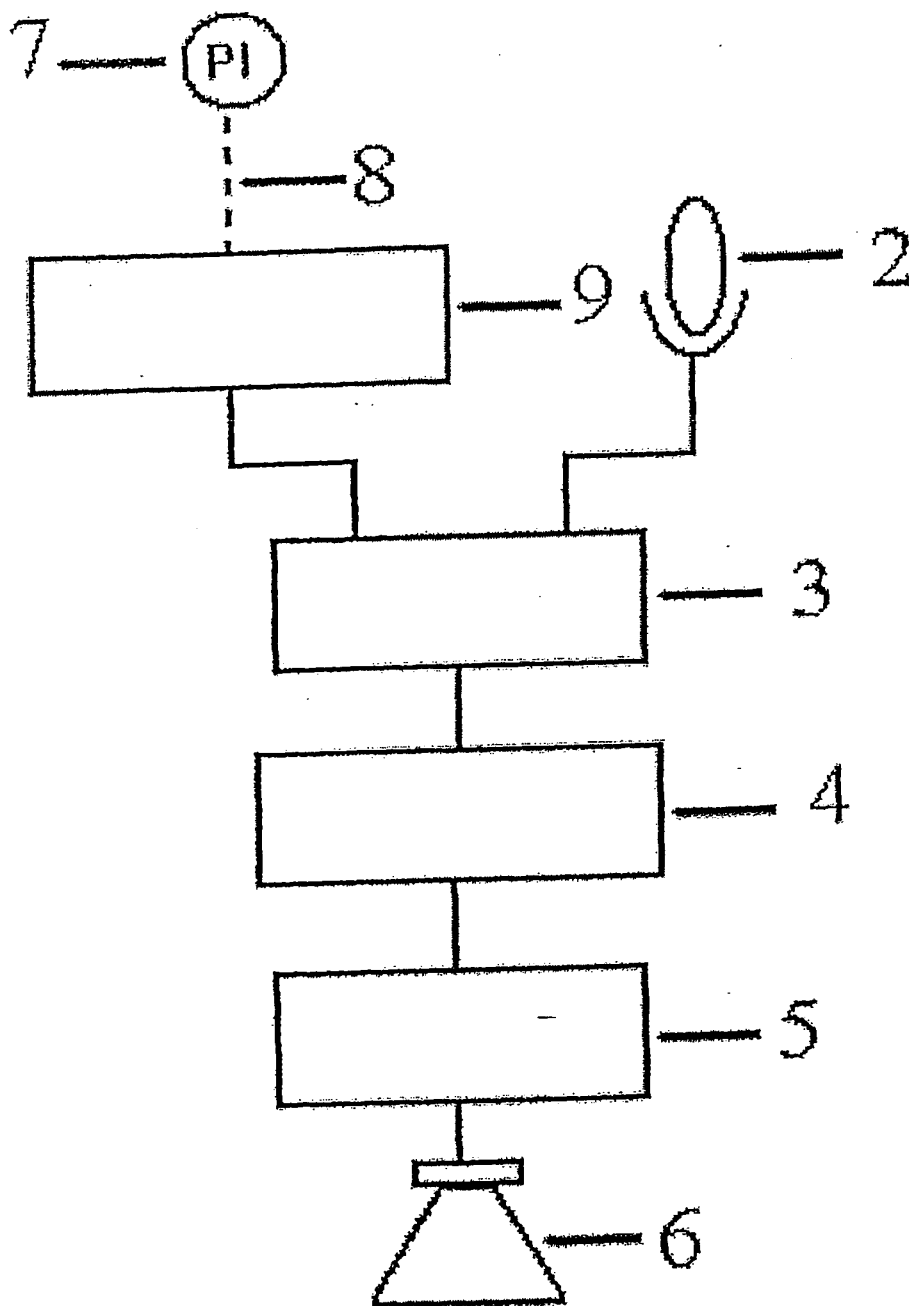


Figure 2

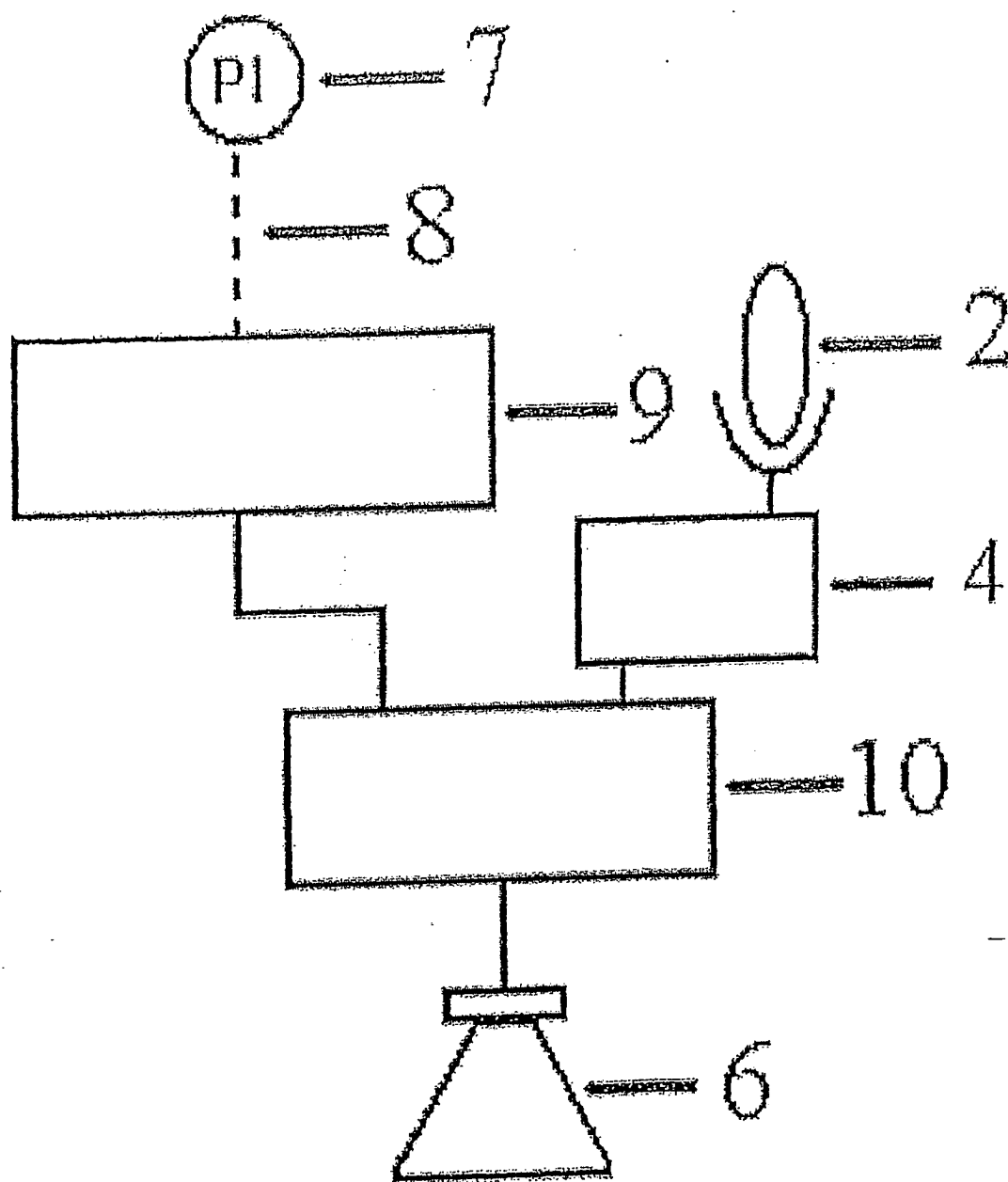


Figure 3